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(71) Applicant *(for all designated States except US)*: OPTOMED OY [FI/FI]; -, Lapinkävijäntie 1, FIN-96100 Rovaniemi (FI).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: BROAS, Markku [FI/FI]; -, Ristontie 10 C, FIN-96300 Rovaniemi (FI).

(74) Agent: LAURINOLLI, Tapio; Patenttitoimisto Tapio Laurinolli, P.O.box 258, FIN-90101 Oulu (FI).

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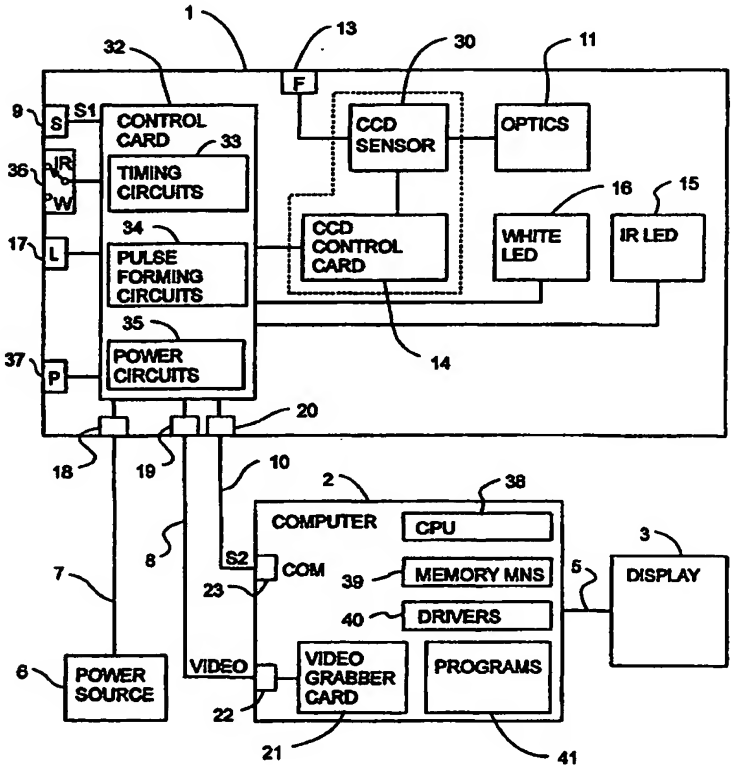
(54) Title: SYSTEM AND DEVICE FOR OPHTHALMOSCOPY



(57) Abstract: A device and system for ophthalmoscopy includes a hand-held camera unit (1) including optics (11) and illuminating means (15, 16) adapted for ophthalmoscopy, an image detector (30) and means (14) for producing a video signal from the image detected by the image detector whereby the video signal may be connected to a digital device (2), like a computer, for processing and displaying the image information. A user gives (9, 32) a first signal (S1) to the camera unit as a still image is desired. In response to the first signal the camera unit produces and supplies a second signal (S2) to said digital device for controlling it to grab and store a still image from said video signal.

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— *Before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

System and device for ophthalmoscopy

The invention is related to a system and device for ophthalmoscopy. The invention is related to this kind of system and device which includes a hand-held video camera adapted for ophthalmoscopy the video signal of which may be connected to a digital device, like a computer, to be processed and presented on a display of the device.

US Patent No. 5701904 presents a diagnostic apparatus in which a video camera, to which e.g. an ophthalmoscope may be connected, is connected to a computer. The computer includes a video grabber card for receiving a video signal and to transform it to digital form suitable for the computer. The apparatus as a whole is meant to be a portable diagnostic pack including a plurality of instruments and, especially, to be accessory equipment for telemedicine applications. The patent does not present any solutions to specific practical problems related to ophthalmoscopy, or to problems, either, arising in telemedical diagnostics, consultation or telecommunication especially as creation and processing of image information concerning a patient is related thereto.

An object of the invention is to provide a solution which takes into account especially the problems of ophthalmoscopy, is easy to use, has low acquisition and operating costs, and is also especially well suited for telemedicine.

To achieve these objects, a system for ophthalmoscopy according to the invention is characterized by that what is defined in claim 1, and a device for ophthalmoscopy according to the invention is characterized by that what is defined in claim 8. Other claims define several embodiments of the system and device of the invention.

A device according to the invention may be built around an image detector, like CCD sensor, and a controller connected thereto which produces a video signal from the image detected by the image detector. A device to which optics suitable for ophthalmoscopy, light sources, simple means for management and control, and connectors are added is quite simple and so the manufacturing costs thereof are low. Additionally, a digital device is needed which is able to display and process the video signal and to store still images grabbed from the video signal. Preferably, the digital device is a PC level computer with a display and an auxiliary video grabber card receiving the video signal and transforming it to a digital form suitable for processing by the computer and a quite simple program for controlling image data processing in the computer. The digital device may be also a digital video camera in the memory of which still images from a video signal may be stored.

A physician examining the eye, normally the fundus of the eye, by means of the device may easily take still images on desired points, and the images are stored automatically in a buffer memory from which they may be removed, or stored permanently to patient records

or other files, or stored for use in telediagnostics or teleconsultations or transmission of patient information from a place to another.

The invention and some embodiments thereof are described in the following in further detail with reference to the accompanying drawings, in which:

Fig. 1 is a diagram presenting generally an embodiment of the system according to the invention;

Fig. 2 is a block diagram presenting the embodiment of Fig. 1 in further detail;

Figs. 3 to 7 present schematically views of an embodiment of the device of the invention from the front, side, behind, above and beneath, respectively;

Fig. 8 is a timing plan which illustrates the operation of an embodiment of the system of the invention; and

Figs. 9 to 12 present schematically alternative signal arrangements between a camera unit and a digital device in the system of the invention.

The device according to the invention presented generally by Fig. 1 is a camera unit 1 for ophthalmoscopy including optics 11 adapted for this purpose and a cheek support 12 which is to be set against the cheek of a patient during the examination of the eye. The device is hold by a handle 26. A press switch 9 for taking a still image and a thumb wheel 13 for focusing are available for the thumb of the hand holding the device. So, the device may be handled by one hand. Power is supplied to the device via a cable 7 from a power source 6 connectable to a plug socket. A video signal produced by the device is connected by a cable 10 to a computer 2. The image is presented on a screen 4 of a display 3 connected by a cable 5 to the computer 2. The display screen may be placed above the head of a patient so that it is easy for a physician using the device to look at an image on the screen. As the physician perceives a point on which he or she desires a still image, he or she gives a signal to the device by pressing the switch 9. In the device there is control electronics which detects the press of the switch and produces another signal which is brought via a connection 8 to the computer 2. In the computer, this signal is detected and in consequence thereof a still image is grabbed from the video signal, stored and displayed on the screen 4.

In the following, parts and operation of an embodiment of the system according to the invention are described with reference to Figs. 2 to 8. The device 1 forming the camera unit includes the optics 11 adapted for ophthalmoscopy, a CCD sensor 30 which detects an image formed by the optics thereon, and a control card 14 thereof which forms a video signal from the image detected by the CCD sensor. Suitable small size combinations of a CCD sensor and a control card are commercially available. The size of a suitable CCD sensor may be 12 millimeters by 12 millimeters, and the size of a suitable control card may be about 150 millimeters by 20 millimeters. Focusing is made by adjusting the position of

the CCD sensor 30 by the adjuster 13. For illuminating the object to be photographed, the device includes an infrared LED 15 and a white LED 16.

Control unit 32 controls the operation of the LEDs, and the video signal produced by the CCD controller 14 is connected via the control unit. The power source 6 which is a power pack connectable to the mains and giving a voltage of 15 volts, for example, is connected to connector 18 of the device and thereby to the control unit 32. The device is switched on by switch 37. Power circuits 35 form different voltages needed by different parts of the device from the voltage given by the power source. By the press switch 9 signal S1 is given to the device as a still image is desired. By switch 36, either IR illumination or white light illumination is selected. By adjuster 17 the intensity of white light is adjusted. The video signal is brought to connector 19. Signalling S2 meant for the computer is brought to connector 20. Timing and pulse forming circuits 33 and 34 form and time current and voltage pulses needed. As is apparent from the following, the operation of the control unit is quite simple, and a person skilled in the art is able to implement it easily in various ways with suitable electronic components and circuits. Accordingly, no detailed descriptions of any exemplary implementations are considered necessary.

The computer 2 is an ordinary PC including e.g. Pentium level processor 38, ordinary memory means 39, like RAM and ROM memories, hard disk and CD ROM, and necessary drivers 40 and programs 41, and a suitable display 3 is connected thereto. The computer is provided with an image grabber card 21 and video connector 22 connected thereto, and with suitable programs for transforming the video signal to digital image data and for displaying the corresponding image on the display 3 connected to the computer by the connection 5. Cable 8 provided with suitable connectors brings the video signal from the connector 19 of the camera unit to the connector 22 of the computer. The other cable 10 provided with suitable connectors is connected from the connector 20 of the camera unit to the COM port connector 23 of the computer.

A possible way of operation of the device and system of the invention is further illustrated by Fig. 8. By the switch 36 of the device 1 either IR mode or white light mode may be selected in which modes, respectively, either the IR LED 15 or the white LED 16 is guided to illuminate the object. In the examination of the fundus of the eye, for example, it is advantageous to use IR mode so that the pupil of the eye does not contract and the examination is easier. In the IR mode a black-and-white image of the fundus is obtained on the display. As a user, normally a physician, moving the camera perceives a point on which he or she wishes to have a still image on, he or she presses the switch 9 whereby the control card 32 receives signal S1, e.g. a voltage pulse. Then, the timing and pulse forming circuits 33 and 34 of the controller guide the IR LED to go off and the white LED to go on for a

certain time T as is indicated by markings IROFF and WON in Fig. 8, respectively. The time T may be 100 ms, for example. In response to signal S1, the timing and pulse forming circuits 33 and 34 produce another signal S2 which is directed via the connector 20 and the cable 10 to the COM port 23 of the computer. Signal S2 is a 5 V voltage pulse according to the standard RS232. Detecting the signal S2, the computer grabs a still image the duration of the white light pulse still continuing, the timing of the still image being indicated by marking I in Fig. 8. The image detector 30 being a colour image detector, a colour image is obtained on the screen with white light. When the devices is used in the white light mode, the corresponding off and on pulses of IR light and white light (IROFF and WON) are of course not formed.

The operation in the computer related to the grabbing and processing of the still image may be as follows, for example. As the voltage pulse S2 is detected in port 23, a still image is grabbed from the video signal coming from the camera unit 1. The still image is stored in the buffer memory, and it is hold on the display automatically for 10 seconds, for example, after which the received video image is again displayed on the display. If a user desires, he or she is able to command the computer to hold the still image on the display for a longer time for further examination. The user is also able to browse and examine previous still images of the same examination stored in the buffer memory, or to compare the images with images of the same patient filed earlier or with reference images for diagnostics which may be obtained on the screen of the computer from some storing means, data base or other source via an external connection. Still images may be stored automatically or by a separate command to the patient information file of the patient under examination, or a report form may be opened to which the images may be attached.

Still images may be in JPEG form, for example, whereby they may be zoomed larger, for example, for presenting further details or handled in other ways possible with graphics programs. The operation described above may be carried out in a computer by adding to suitable commercial graphics programs and telemedicine application programs quite simple further programs needed for detecting a signal received in COM port and for guiding the computer consecutively to grab a still image, store it in the buffer memory and hold it on the display screen for a certain time.

The design of the device according to the invention presented in Figs. 3 to 7 is pistol-shaped. It includes handle part 26 and part 27 extending forward thereof and including the optics part 11 and the support part 12. Inside the optics part 11 there is a lense arrangement 24 which is adapted for focusing the image of the fundus of the eye, for example, on the image detector 30 (Fig. 4). For focusing, the image detector is movable as is indicated by arrow 31. The mechanism is not presented, but the image detector may be attached to a

sliding rack bar, for example, moved by a rack wheel attached to the adjuster wheel 13. The IR LED 15 and the white LED 16 are attached in a cavity 29 in the support part 12, and thereabove in front of the lense arrangement 24 at the lower edge thereof a mirror 25 is placed which directs the light of the LEDs to the object. The thumb wheel 13 adjusting focusing, the other thumb wheel 17 adjusting the intensity of light by means of a potentiometer, for example, and the press switch 9 are placed in such a way that a user may manipulate them with the thumb of the hand holding the handle 26. On the bottom 28 of the handle part (Fig. 7) there are necesary connectors and other switches: on-off-switch 37, the switch 36 for selecting IR or white light mode, the connector 18 for the power source, the video connector 19, and the signal connector 20.

The digital device by which a video signal is displayed and processed may be also a palm computer or similar hand-held device in which the processing of a video signal and the grabbing and storing of a still image are carried out in a similar way than in a PC. The digital device may be also a digital video camera, for example, to which a video signal may be connected and which displays the image information included in the signal. In response to signal S2 coming from the camera unit, the video camera is guided to still mode in which it stores the still image.

There are many alternatives to carry out signal S1 to be given to the camera unit and the corresponding signal S2 to be supplied to the digital device. Some of them are presented generally in Figs. 9 to 12. Fig. 9 presents schematically the signalling alternative an implementation of which the solution described above in detail is. Signal S1 is given directly to the camera unit 1, and signal S2 is given to the digital device 2, like a PC, separately. Signal S1 for taking a still image may be given to the camera unit 1 also with a cable release, for example, the camera unit then including a connector and detection electronics for cable release, or even with voice, the camera unit then having a microphone and necessary electronics for voice control.

Fig. 10 presents an alternative in which signal S1 is given directly to the camera unit and signal S2 is supplied to the device 2 in connection with the video signal. Signal S2 may then be a vigorous change of white level (of a frame or certain pixels), for example, resulted in as the visible light LED is switched on instead of the IR LED. Also R component of the video signal may be monitored and detected in the digital device, a vigorous change of the R component also occuring with switching from IR mode to visible light mode. If a still image is desired in the visible light mode, a long enough blanking period may be arranged in the video signal, the blanking period then functioning as signal S2 and being detected in the digital device.

In the alternative of Fig. 11, either signal S1 may be given to the camera unit 1 directly or signal S1' may be given by means of the digital device, e.g. a computer, for taking a still image. Signal S1' may be e.g. a voltage pulse connected via the serial port and produced by clicking a mouse button. In the alternative of Fig. 12 no signal can be given directly to the camera unit but only signal S1' via the digital device.

There may be also several options in the camera unit for giving therto signal S1 directly or a corresponding signal.

Some embodiments of the invention are described above in detail, the invention naturally not being restricted thereto. For example, in the device according to the invention an embodiment of which is described with reference to Figs. 3 to 7, the adjusters, switches and external connections could be implemented in many different ways. Instead of thumb wheels, for example, slide controls could be used, and the press switch could be implemented and placed in a similar way than a trigger. The press switch or corresponding means for providing a signal may be a simple switch closing and opening a circuit, or it may be a capacitive switch, for example.

The invention may be varied within the scope of the accompanying claims.

Claims

1. A system for ophthalmoscopy including:

a hand-held camera unit including optics (11) and illuminating means (15, 16, 25) adapted for ophthalmoscopy, an image detector (30) and means (14) for producing a video signal from the image detected by the image detector,

a first output connection (19) for said video signal, and

a digital device (2) for receiving, processing and displaying on a display (3, 4) the video signal,

characterized in that:

means (9, 32; 10b, 20, 23) for a user of the device are connected to the camera unit (1) for giving a first signal (S1, S1') to the camera unit as a still image is desired;

in response to the first signal (S1, S1') the camera unit (1, 32; 1, 14) produces a second signal (S2) to be supplied (10, 10a, 20, 23; 8, 19, 22) to said digital device (2); and

in response to the second signal (S2) the digital device (2) grabs a still image from the video signal and stores it in a memory.

2. A system according to claim 1, **characterized** in that the digital device (2) is a computer provided with a display (3).

3. A system according to claim 1, **characterized** in that the digital device (2) is a digital video camera.

4. A system according to claim 1, **characterized** in that means for giving the first signal (S1) include a press switch (9) in the camera unit (1).

5. A system according to claim 1, **characterized** in that the second signal (S2) is a voltage pulse (Fig. 8).

6. A system according to claim 1, **characterized** in that the second signal (S2) is a defined change in the video signal, the digital device (2) being programmed to detect the change.

7. A system according to claim 1, **characterized** in that it includes:

an infrared light source (15) and a visible light source (16) as illuminating means;

means (36, 33, 34) for selecting illumination with either infrared light or visible light and for switching a corresponding light source (15, 16) on; and

means (33, 34) for switching the visible light source on as a pulse (WON) in response to the first signal (S1) for obtaining the still image (I) with visible light as the infrared illumination is selected.

8. A device for ophthalmoscopy including:

a hand-held camera unit (1) including optics (11) and illuminating means (15, 16, 25) adapted for ophthalmoscopy, an image detector (30) and means (14) for producing a video signal from the image detected by the image detector; and

a first output connection (19) for said video signal whereby the video signal may be connected to a digital device (2) for processing and displaying the image information;

characterized in that it further includes:

means (9, 32; 10b, 20, 23) for a user of the device for giving a first signal (S1, S1') to the camera unit (1) as a still image is desired;

means (32) for producing a second signal (S2) in response to said first signal (S1) and supplying the same to said digital device (2) for controlling it to grab and store a still image.

9. A device according to claim 8, **characterized** in that means for giving the first signal (S1) include a press switch (9).

10. A device according to claim 8, **characterized** in that the camera unit (1) is a pistol-shaped device including a handle part (26) and control and adjusting means including means (9) for giving the first signal in a place available for the thumb of the hand holding the handle part (26).

11. A device according to claim 10, **characterized** in that said control and adjusting means include focusing means (13) and/or means (17) for adjusting intensity of illumination.

12. A device according to claim 8, **characterized** in that it includes:

an infrared light source (15) and a visible light source (16) as illuminating means;

means (36, 33, 34) for selecting illumination with either infrared light or visible light and for switching a corresponding light source (15, 16) on; and

means (33, 34) for switching the visible light source on as a pulse (WON) in response to the first signal (S1) as the infrared illumination is selected for obtaining the still image (I) with visible light.

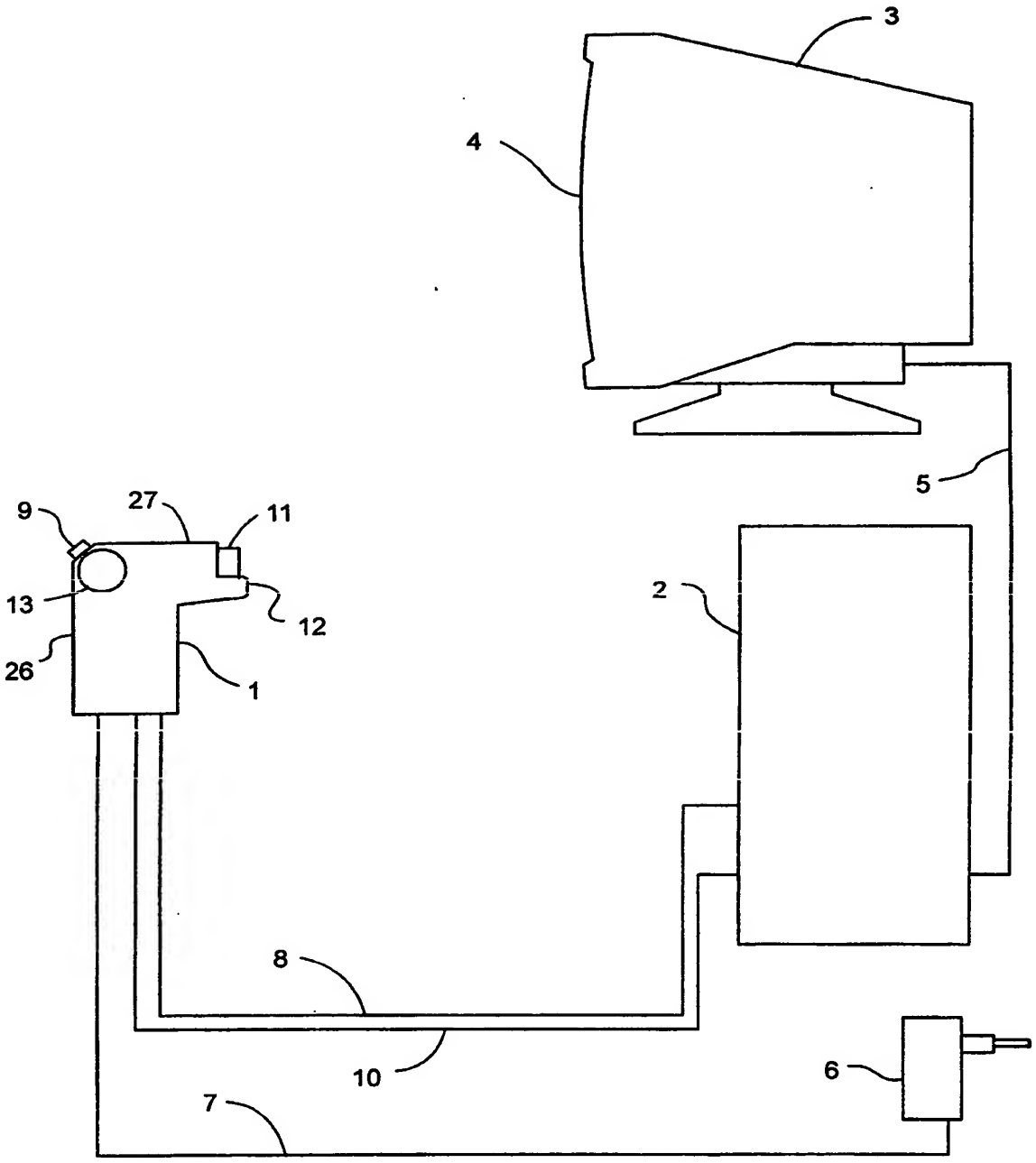
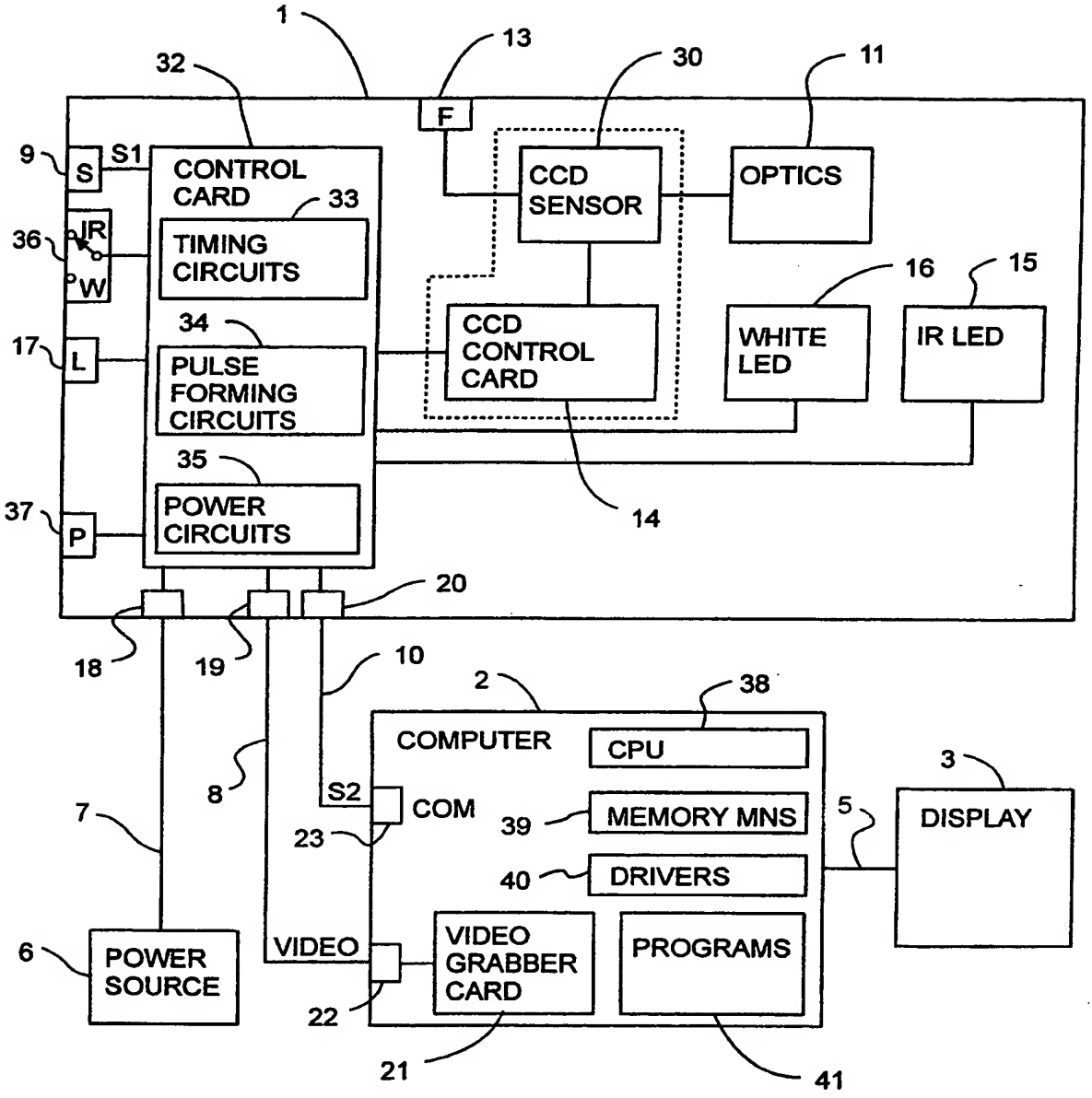


Fig. 1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13
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S1
CONTROL CARD
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CCD SENSOR
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VIDEO GRABBER CARD
PROGRAMS
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21
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Fig. 2

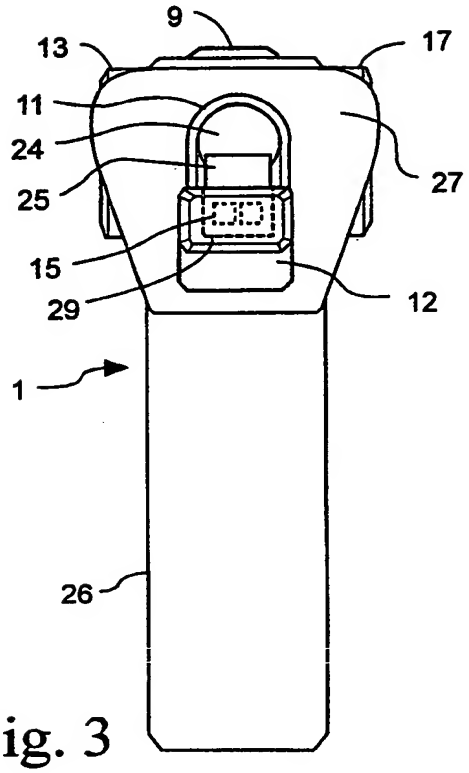

Fig. 3

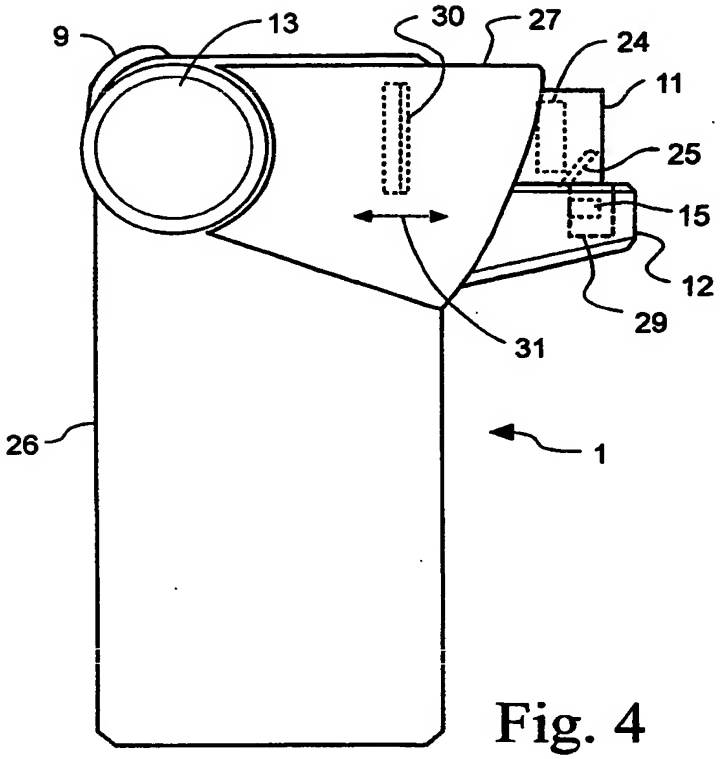

Fig. 4

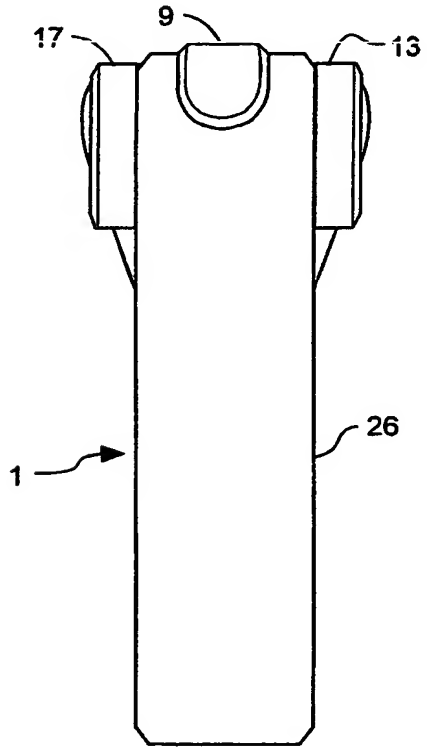

Fig. 5

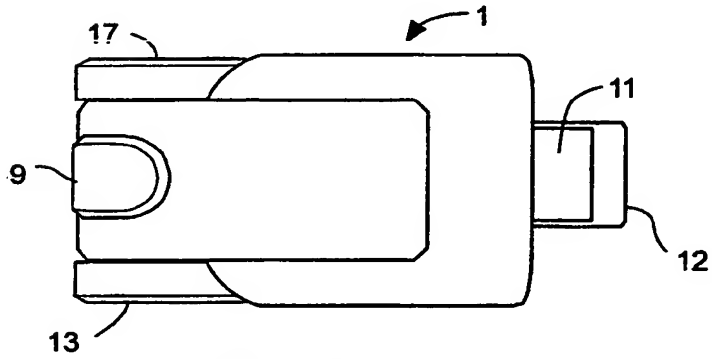

Fig. 6

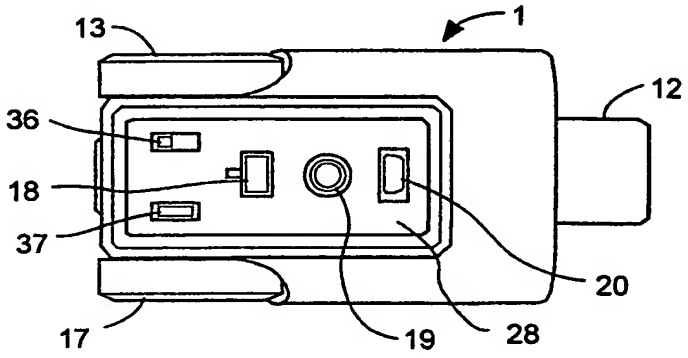

Fig. 7

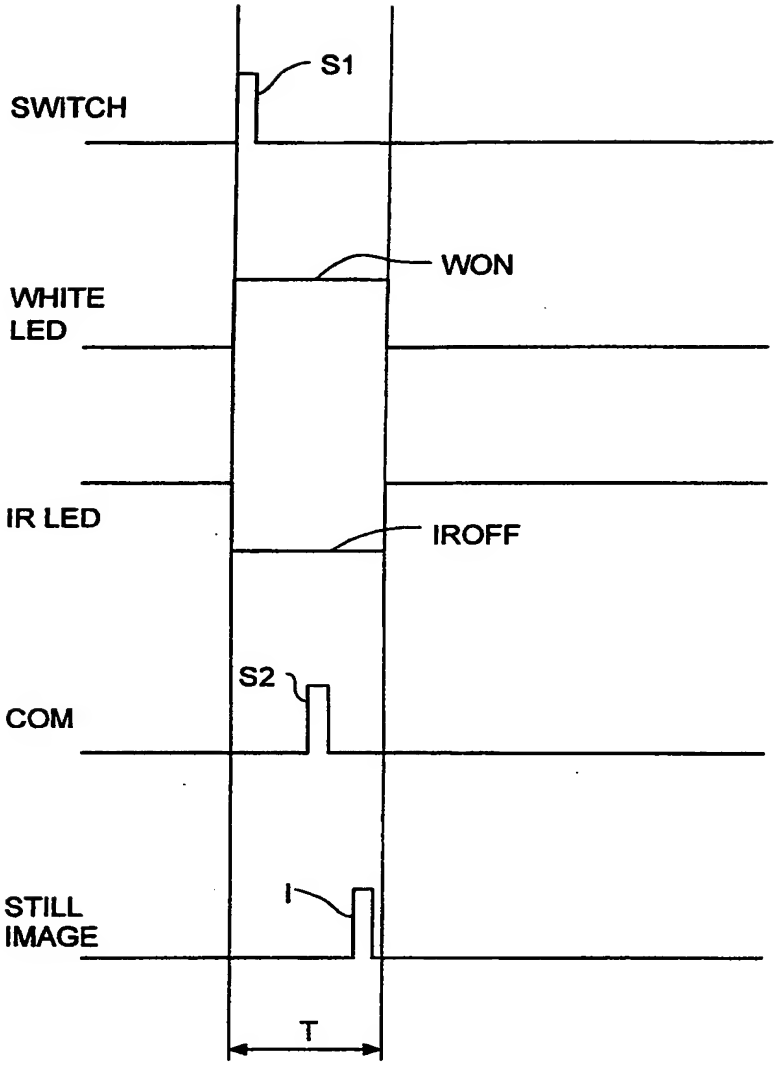

Fig. 8

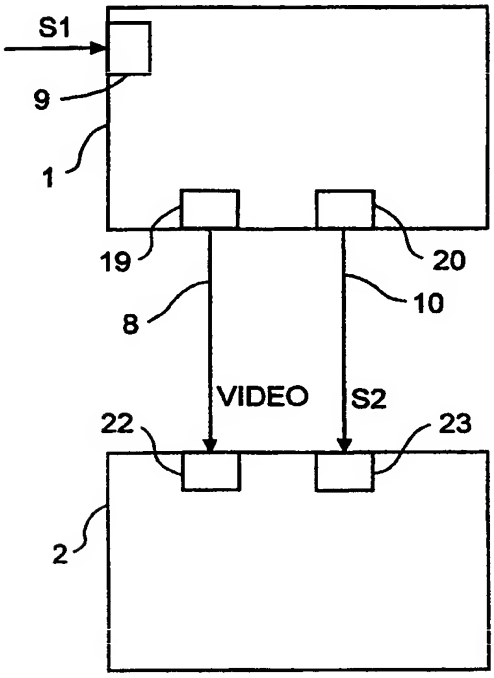

Fig. 9

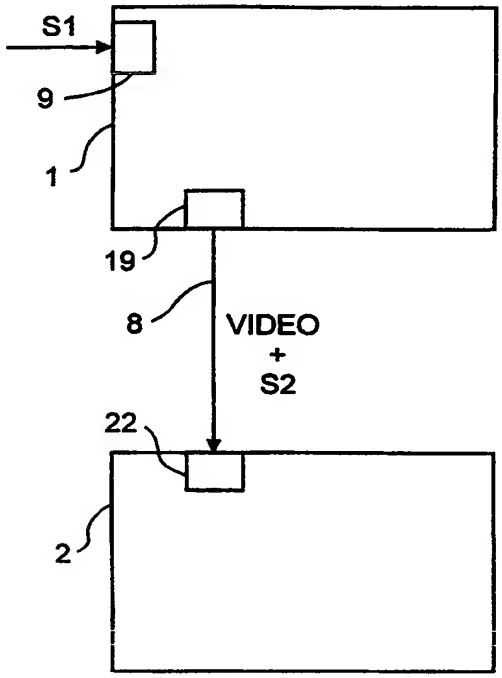

Fig. 10

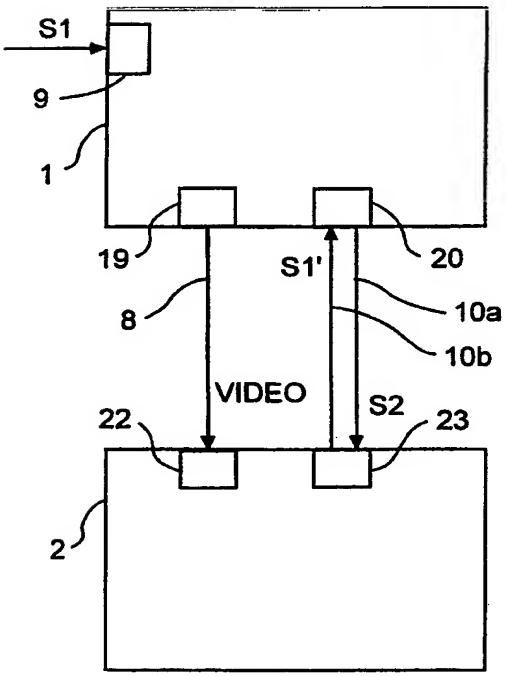

Fig. 11

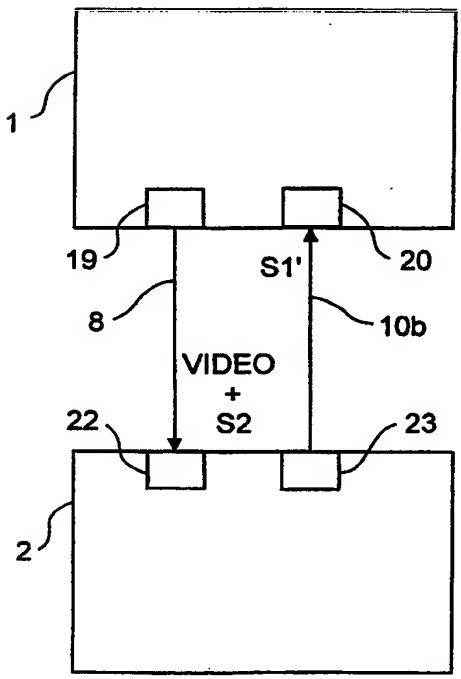

Fig. 12

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 00/00449

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: A61B 3/12, A61B 3/14
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: A61B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5668621 A (T. NANJO), 16 Sept 1997 (16.09.97), column 4, line 19 - line 67; column 6, line 18 - line 30	1-12
A	US 5125730 A (G.R. TAYLOR ET AL.), 30 June 1992 (30.06.92), column 9, line 3 - line 40, abstract	1-12
A	US 5202708 A (K. SASAKI ET AL.), 13 April 1993 (13.04.93), column 8, line 40 - line 46, abstract	1-12

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 Sept 2000	25 -09- 2000
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Nikolaj Hautaviita/AE Telephone No. +46 8 782 25 00

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System and device for ophthalmoscopy

The invention is related to a system and device for ophthalmoscopy. The invention is related to this kind of system and device which includes a hand-held video camera adapted for ophthalmoscopy the video signal of which may be connected to a digital device, like a computer, to be processed and presented on a display of the device.

US Patent No. 5701904 presents a diagnostic apparatus in which a video camera, to which e.g. an ophthalmoscope may be connected, is connected to a computer. The computer includes a video grabber card for receiving a video signal and to transform it to digital form suitable for the computer. The apparatus as a whole is meant to be a portable diagnostic pack including a plurality of instruments and, especially, to be accessory equipment for telemedicine applications. The patent does not present any solutions to specific practical problems related to ophthalmoscopy, or to problems, either, arising in telemedical diagnostics, consultation or telecommunication especially as creation and processing of image information concerning a patient is related thereto.

An object of the invention is to provide a solution which takes into account especially the problems of ophthalmoscopy, is easy to use, has low acquisition and operating costs, and is also especially well suited for telemedicine.

To achieve these objects, a system for ophthalmoscopy according to the invention is characterized by that what is defined in claim 1, and a device for ophthalmoscopy according to the invention is characterized by that what is defined in claim 8. Other claims define several embodiments of the system and device of the invention.

A device according to the invention may be built around an image detector, like CCD sensor, and a controller connected thereto which produces a video signal from the image detected by the image detector. A device to which optics suitable for ophthalmoscopy, light sources, simple means for management and control, and connectors are added is quite simple and so the manufacturing costs thereof are low. Additionally, a digital device is needed which is able to display and process the video signal and to store still images grabbed from the video signal. Preferably, the digital device is a PC level computer with a display and an auxiliary video grabber card receiving the video signal and transforming it to a digital form suitable for processing by the computer and a quite simple program for controlling image data processing in the computer. The digital device may be also a digital video camera in the memory of which still images from a video signal may be stored.

A physician examining the eye, normally the fundus of the eye, by means of the device may easily take still images on desired points, and the images are stored automatically in a buffer memory from which they may be removed, or stored permanently to patient records

or other files, or stored for use in telediagnostics or teleconsultations or transmission of patient information from a place to another.

The invention and some embodiments thereof are described in the following in further detail with reference to the accompanying drawings, in which:

Fig. 1 is a diagram presenting generally an embodiment of the system according to the invention;

Fig. 2 is a block diagram presenting the embodiment of Fig. 1 in further detail;

Figs. 3 to 7 present schematically views of an embodiment of the device of the invention from the front, side, behind, above and beneath, respectively;

Fig. 8 is a timing plan which illustrates the operation of an embodiment of the system of the invention; and

Figs. 9 to 12 present schematically alternative signal arrangements between a camera unit and a digital device in the system of the invention.

The device according to the invention presented generally by Fig. 1 is a camera unit 1 for ophthalmoscopy including optics 11 adapted for this purpose and a cheek support 12 which is to be set against the cheek of a patient during the examination of the eye. The device is hold by a handle 26. A press switch 9 for taking a still image and a thumb wheel 13 for focusing are available for the thumb of the hand holding the device. So, the device may be handled by one hand. Power is supplied to the device via a cable 7 from a power source 6 connectable to a plug socket. A video signal produced by the device is connected by a cable 10 to a computer 2. The image is presented on a screen 4 of a display 3 connected by a cable 5 to the computer 2. The display screen may be placed above the head of a patient so that it is easy for a physician using the device to look at an image on the screen. As the physician perceives a point on which he or she desires a still image, he or she gives a signal to the device by pressing the switch 9. In the device there is control electronics which detects the press of the switch and produces another signal which is brought via a connection 8 to the computer 2. In the computer, this signal is detected and in consequence thereof a still image is grabbed from the video signal, stored and displayed on the screen 4.

In the following, parts and operation of an embodiment of the system according to the invention are described with reference to Figs. 2 to 8. The device 1 forming the camera unit includes the optics 11 adapted for ophthalmoscopy, a CCD sensor 30 which detects an image formed by the optics thereon, and a control card 14 thereof which forms a video signal from the image detected by the CCD sensor. Suitable small size combinations of a CCD sensor and a control card are commercially available. The size of a suitable CCD sensor may be 12 millimeters by 12 millimeters, and the size of a suitable control card may be about 150 millimeters by 20 millimeters. Focusing is made by adjusting the position of

the CCD sensor 30 by the adjuster 13. For illuminating the object to be photographed, the device includes an infrared LED 15 and a white LED 16.

Control unit 32 controls the operation of the LEDs, and the video signal produced by the CCD controller 14 is connected via the control unit. The power source 6 which is a power pack connectable to the mains and giving a voltage of 15 volts, for example, is connected to connector 18 of the device and thereby to the control unit 32. The device is switched on by switch 37. Power circuits 35 form different voltages needed by different parts of the device from the voltage given by the power source. By the press switch 9 signal S1 is given to the device as a still image is desired. By switch 36, either IR illumination or white light illumination is selected. By adjuster 17 the intensity of white light is adjusted. The video signal is brought to connector 19. Signalling S2 meant for the computer is brought to connector 20. Timing and pulse forming circuits 33 and 34 form and time current and voltage pulses needed. As is apparent from the following, the operation of the control unit is quite simple, and a person skilled in the art is able to implement it easily in various ways with suitable electronic components and circuits. Accordingly, no detailed descriptions of any exemplary implementations are considered necessary.

The computer 2 is an ordinary PC including e.g. Pentium level processor 38, ordinary memory means 39, like RAM and ROM memories, hard disk and CD ROM, and necessary drivers 40 and programs 41, and a suitable display 3 is connected thereto. The computer is provided with an image grabber card 21 and video connector 22 connected thereto, and with suitable programs for transforming the video signal to digital image data and for displaying the corresponding image on the display 3 connected to the computer by the connection 5. Cable 8 provided with suitable connectors brings the video signal from the connector 19 of the camera unit to the connector 22 of the computer. The other cable 10 provided with suitable connectors is connected from the connector 20 of the camera unit to the COM port connector 23 of the computer.

A possible way of operation of the device and system of the invention is further illustrated by Fig. 8. By the switch 36 of the device 1 either IR mode or white light mode may be selected in which modes, respectively, either the IR LED 15 or the white LED 16 is guided to illuminate the object. In the examination of the fundus of the eye, for example, it is advantageous to use IR mode so that the pupil of the eye does not contract and the examination is easier. In the IR mode a black-and-white image of the fundus is obtained on the display. As a user, normally a physician, moving the camera perceives a point on which he or she wishes to have a still image on, he or she presses the switch 9 whereby the control card 32 receives signal S1, e.g. a voltage pulse. Then, the timing and pulse forming circuits 33 and 34 of the controller guide the IR LED to go off and the white LED to go on for a

certain time T as is indicated by markings IROFF and WON in Fig. 8, respectively. The time T may be 100 ms, for example. In response to signal S1, the timing and pulse forming circuits 33 and 34 produce another signal S2 which is directed via the connector 20 and the cable 10 to the COM port 23 of the computer. Signal S2 is a 5 V voltage pulse according to the standard RS232. Detecting the signal S2, the computer grabs a still image the duration of the white light pulse still continuing, the timing of the still image being indicated by marking I in Fig. 8. The image detector 30 being a colour image detector, a colour image is obtained on the screen with white light. When the devices is used in the white light mode, the corresponding off and on pulses of IR light and white light (IROFF and WON) are of course not formed.

The operation in the computer related to the grabbing and processing of the still image may be as follows, for example. As the voltage pulse S2 is detected in port 23, a still image is grabbed from the video signal coming from the camera unit 1. The still image is stored in the buffer memory, and it is hold on the display automatically for 10 seconds, for example, after which the received video image is again displayed on the display. If a user desires, he or she is able to command the computer to hold the still image on the display for a longer time for further examination. The user is also able to browse and examine previous still images of the same examination stored in the buffer memory, or to compare the images with images of the same patient filed earlier or with reference images for diagnostics which may be obtained on the screen of the computer from some storing means, data base or other source via an external connection. Still images may be stored automatically or by a separate command to the patient information file of the patient under examination, or a report form may be opened to which the images may be attached.

Still images may be in JPEG form, for example, whereby they may be zoomed larger, for example, for presenting further details or handled in other ways possible with graphics programs. The operation described above may be carried out in a computer by adding to suitable commercial graphics programs and telemedicine application programs quite simple further programs needed for detecting a signal received in COM port and for guiding the computer consecutively to grab a still image, store it in the buffer memory and hold it on the display screen for a certain time.

The design of the device according to the invention presented in Figs. 3 to 7 is pistol-shaped. It includes handle part 26 and part 27 extending forward thereof and including the optics part 11 and the support part 12. Inside the optics part 11 there is a lense arrangement 24 which is adapted for focusing the image of the fundus of the eye, for example, on the image detector 30 (Fig. 4). For focusing, the image detector is movable as is indicated by arrow 31. The mechanism is not presented, but the image detector may be attached to a

sliding rack bar, for example, moved by a rack wheel attached to the adjuster wheel 13. The IR LED 15 and the white LED 16 are attached in a cavity 29 in the support part 12, and thereabove in front of the lense arrangement 24 at the lower edge thereof a mirror 25 is placed which directs the light of the LEDs to the object. The thumb wheel 13 adjusting focusing, the other thumb wheel 17 adjusting the intensity of light by means of a potentiometer, for example, and the press switch 9 are placed in such a way that a user may manipulate them with the thumb of the hand holding the handle 26. On the bottom 28 of the handle part (Fig. 7) there are necesary connectors and other switches: on-off-switch 37, the switch 36 for selecting IR or white light mode, the connector 18 for the power source, the video connector 19, and the signal connector 20.

The digital device by which a video signal is displayed and processed may be also a palm computer or similar hand-held device in which the processing of a video signal and the grabbing and storing of a still image are carried out in a similar way than in a PC. The digital device may be also a digital video camera, for example, to which a video signal may be connected and which displays the image information included in the signal. In response to signal S2 coming from the camera unit, the video camera is guided to still mode in which it stores the still image.

There are many alternatives to carry out signal S1 to be given to the camera unit and the corresponding signal S2 to be supplied to the digital device. Some of them are presented generally in Figs. 9 to 12. Fig. 9 presents schematically the signalling alternative an implementation of which the solution described above in detail is. Signal S1 is given directly to the camera unit 1, and signal S2 is given to the digital device 2, like a PC, separately. Signal S1 for taking a still image may be given to the camera unit 1 also with a cable release, for example, the camera unit then including a connector and detection electronics for cable release, or even with voice, the camera unit then having a microphone and necessary electronics for voice control.

Fig. 10 presents an alternative in which signal S1 is given directly to the camera unit and signal S2 is supplied to the device 2 in connection with the video signal. Signal S2 may then be a vigorous change of white level (of a frame or certain pixels), for example, resulted in as the visible light LED is switched on instead of the IR LED. Also R component of the video signal may be monitored and detected in the digital device, a vigorous change of the R component also occuring with switching from IR mode to visible light mode. If a still image is desired in the visible light mode, a long enough blanking period may be arranged in the video signal, the blanking period then functioning as signal S2 and being detected in the digital device.

In the alternative of Fig. 11, either signal S1 may be given to the camera unit 1 directly or signal S1' may be given by means of the digital device, e.g. a computer, for taking a still image. Signal S1' may be e.g. a voltage pulse connected via the serial port and produced by clicking a mouse button. In the alternative of Fig. 12 no signal can be given directly to the camera unit but only signal S1' via the digital device.

There may be also several options in the camera unit for giving therto signal S1 directly or a corresponding signal.

Some embodiments of the invention are described above in detail, the invention naturally not being restricted thereto. For example, in the device according to the invention an embodiment of which is described with reference to Figs. 3 to 7, the adjusters, switches and external connections could be implemented in many different ways. Instead of thumb wheels, for example, slide controls could be used, and the press switch could be implemented and placed in a similar way than a trigger. The press switch or corresponding means for providing a signal may be a simple switch closing and opening a circuit, or it may be a capacitive switch, for example.

The invention may be varied within the scope of the accompanying claims.

Claims

1. A system for ophthalmoscopy including:

a hand-held camera unit including optics (11) and illuminating means (15, 16, 25) adapted for ophthalmoscopy, an image detector (30) and means (14) for producing a video signal from the image detected by the image detector,

a first output connection (19) for said video signal, and

a digital device (2) for receiving, processing and displaying on a display (3, 4) the video signal,

characterized in that:

means (9, 32; 10b, 20, 23) for a user of the device are connected to the camera unit (1) for giving a first signal (S1, S1') to the camera unit as a still image is desired;

in response to the first signal (S1, S1') the camera unit (1, 32; 1, 14) produces a second signal (S2) to be supplied (10, 10a, 20, 23; 8, 19, 22) to said digital device (2); and

in response to the second signal (S2) the digital device (2) grabs a still image from the video signal and stores it in a memory.

2. A system according to claim 1, **characterized** in that the digital device (2) is a computer provided with a display (3).

3. A system according to claim 1, **characterized** in that the digital device (2) is a digital video camera.

4. A system according to claim 1, **characterized** in that means for giving the first signal (S1) include a press switch (9) in the camera unit (1).

5. A system according to claim 1, **characterized** in that the second signal (S2) is a voltage pulse (Fig. 8).

6. A system according to claim 1, **characterized** in that the second signal (S2) is a defined change in the video signal, the digital device (2) being programmed to detect the change.

7. A system according to claim 1, **characterized** in that it includes:

an infrared light source (15) and a visible light source (16) as illuminating means;

means (36, 33, 34) for selecting illumination with either infrared light or visible light and for switching a corresponding light source (15, 16) on; and

means (33, 34) for switching the visible light source on as a pulse (WON) in response to the first signal (S1) for obtaining the still image (I) with visible light as the infrared illumination is selected.

8. A device for ophthalmoscopy including:

a hand-held camera unit (1) including optics (11) and illuminating means (15, 16, 25) adapted for ophthalmoscopy, an image detector (30) and means (14) for producing a video signal from the image detected by the image detector; and

a first output connection (19) for said video signal whereby the video signal may be connected to a digital device (2) for processing and displaying the image information;

characterized in that it further includes:

means (9, 32; 10b, 20, 23) for a user of the device for giving a first signal (S1, S1') to the camera unit (1) as a still image is desired;

means (32) for producing a second signal (S2) in response to said first signal (S1) and supplying the same to said digital device (2) for controlling it to grab and store a still image.

9. A device according to claim 8, **characterized** in that means for giving the first signal (S1) include a press switch (9).

10. A device according to claim 8, **characterized** in that the camera unit (1) is a pistol-shaped device including a handle part (26) and control and adjusting means including means (9) for giving the first signal in a place available for the thumb of the hand holding the handle part (26).

11. A device according to claim 10, **characterized** in that said control and adjusting means include focusing means (13) and/or means (17) for adjusting intensity of illumination.

12. A device according to claim 8, **characterized** in that it includes:

an infrared light source (15) and a visible light source (16) as illuminating means;

means (36, 33, 34) for selecting illumination with either infrared light or visible light and for switching a corresponding light source (15, 16) on; and

means (33, 34) for switching the visible light source on as a pulse (WON) in response to the first signal (S1) as the infrared illumination is selected for obtaining the still image (I) with visible light.

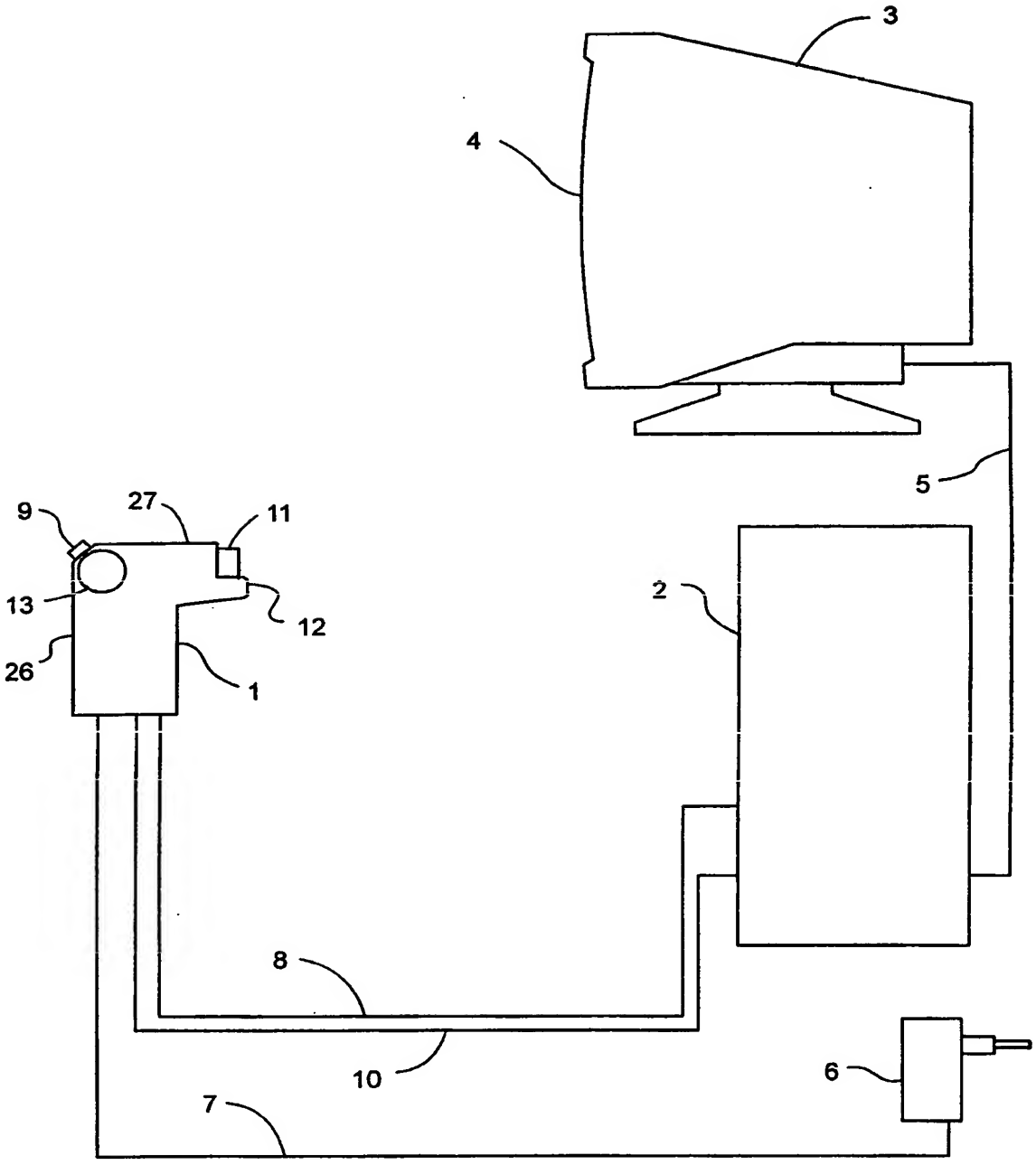
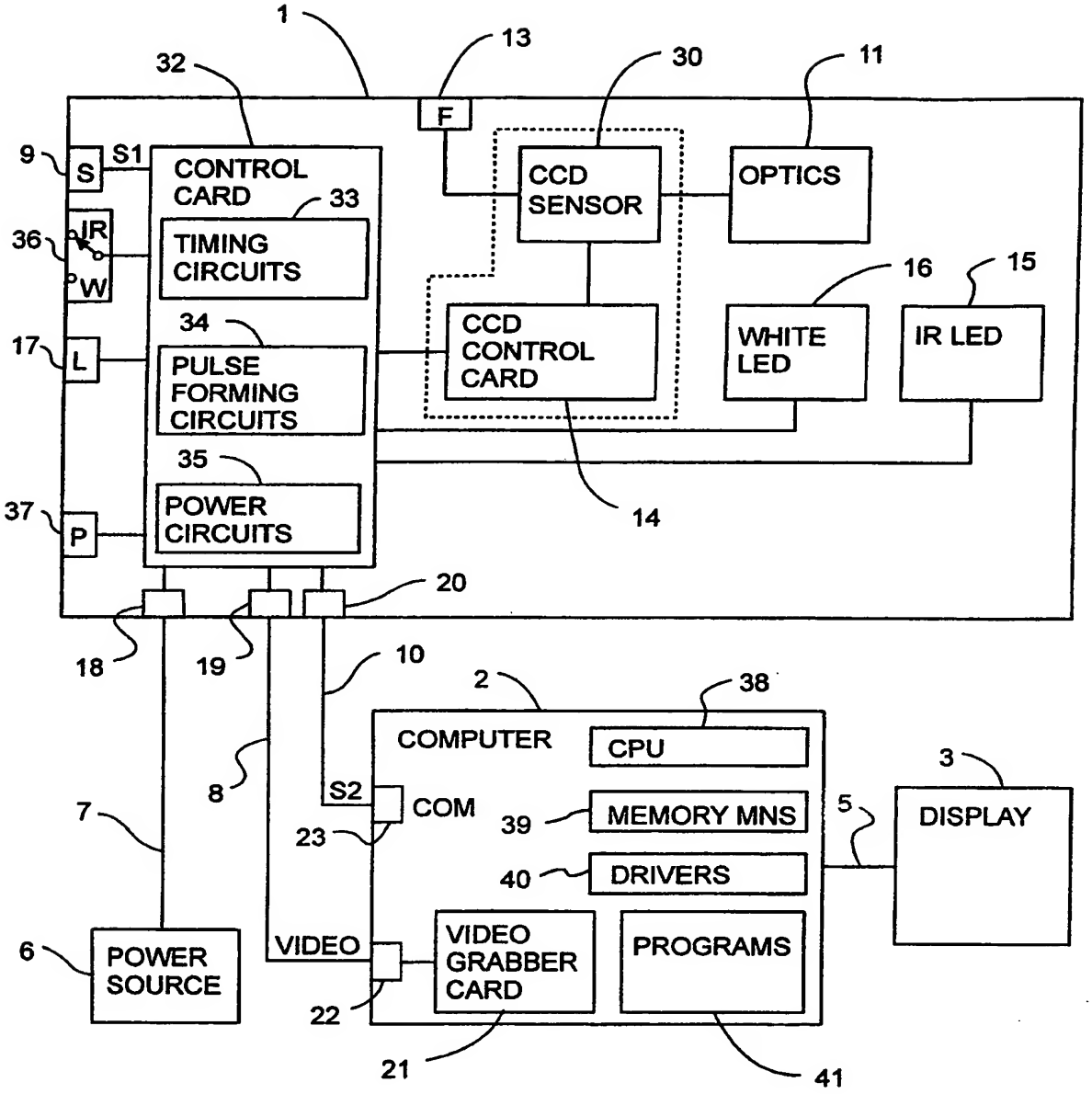


Fig. 1


1
13
30
11
32
F
9
S
S1
CONTROL CARD
33
CCD SENSOR
OPTICS
36
IR
W
TIMING CIRCUITS
16
15
34
CCD CONTROL CARD
WHITE LED
IR LED
17
L
PULSE FORMING CIRCUITS
35
14
37
P
POWER CIRCUITS
20
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2
38
COMPUTER
CPU
3
8
S2
COM
39
MEMORY MNS
5
DISPLAY
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DRIVERS
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POWER SOURCE
VIDEO
VIDEO GRABBER CARD
PROGRAMS
22
21
41

Fig. 2

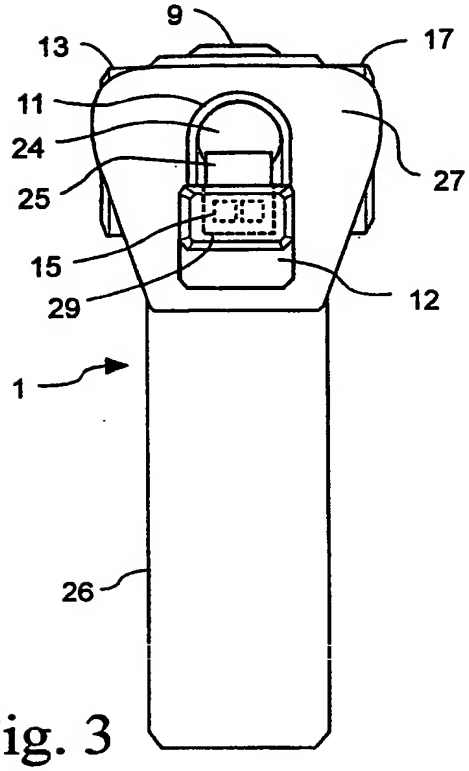

Fig. 3

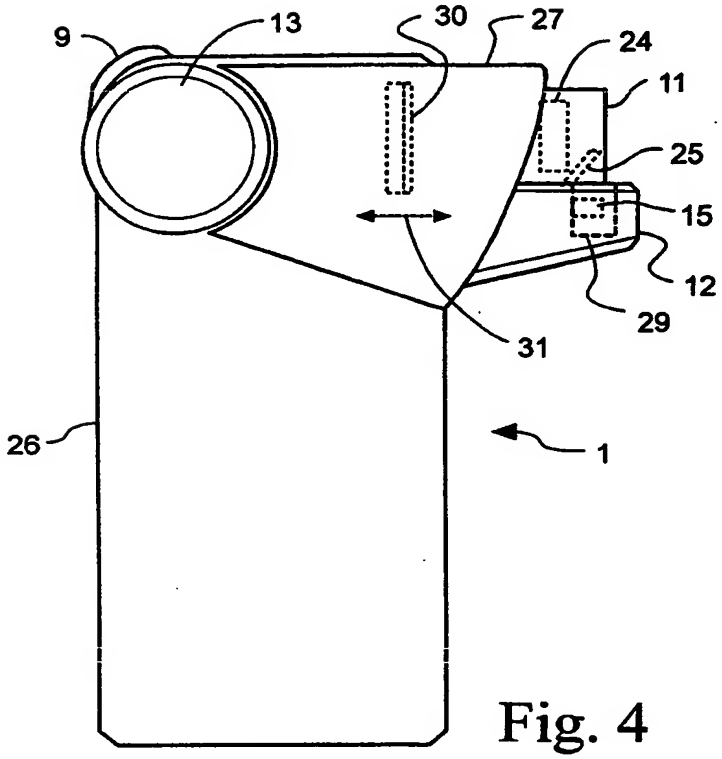

Fig. 4

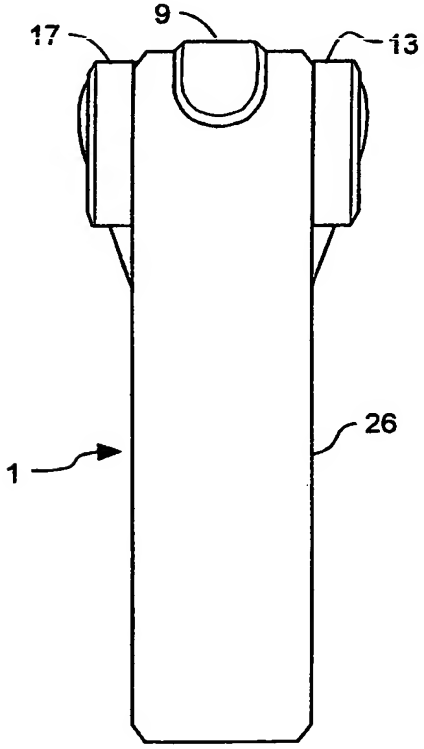

Fig. 5

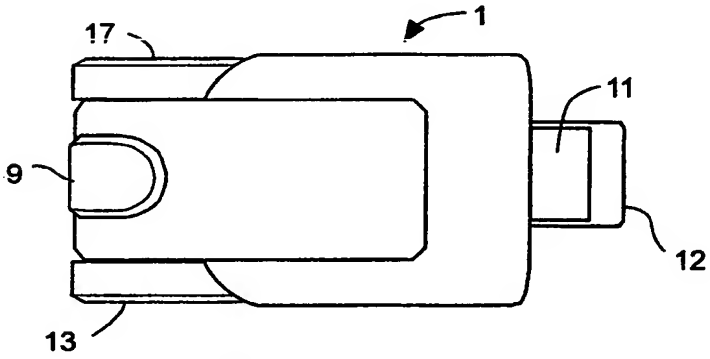

Fig. 6

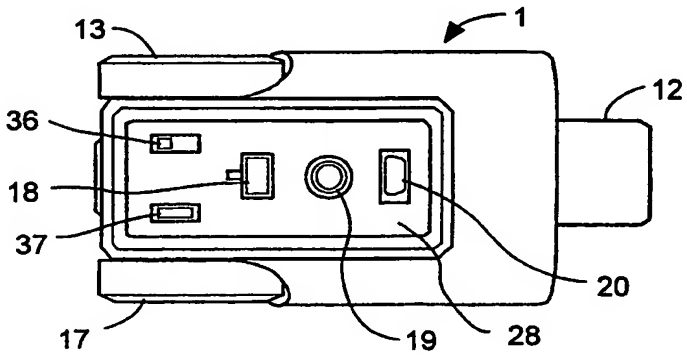

Fig. 7

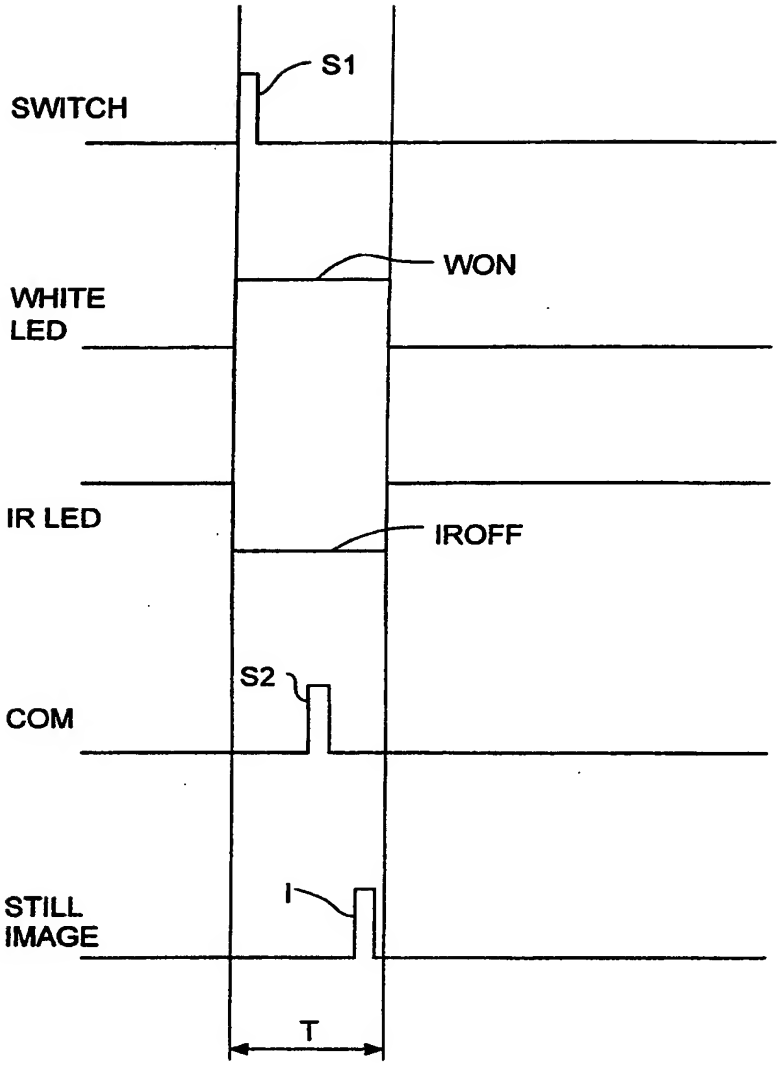

Fig. 8

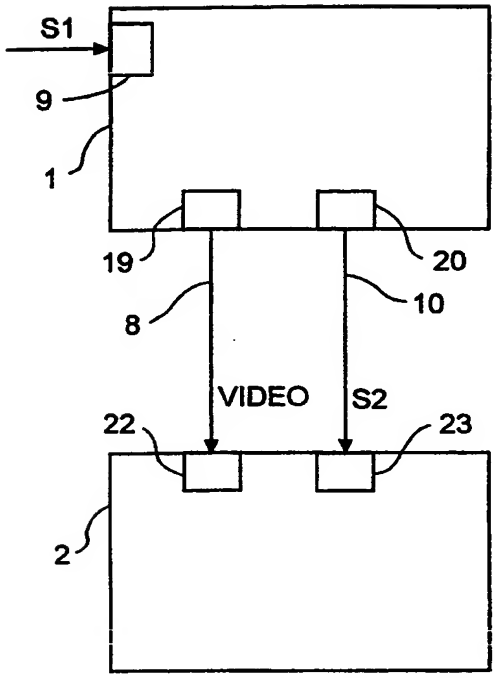

Fig. 9

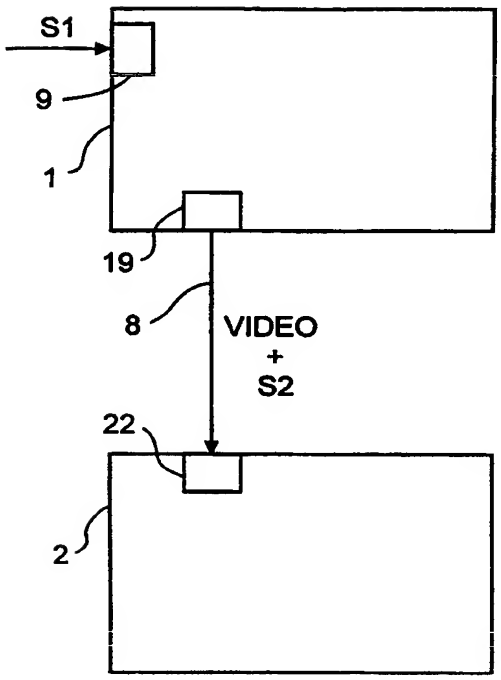

Fig. 10

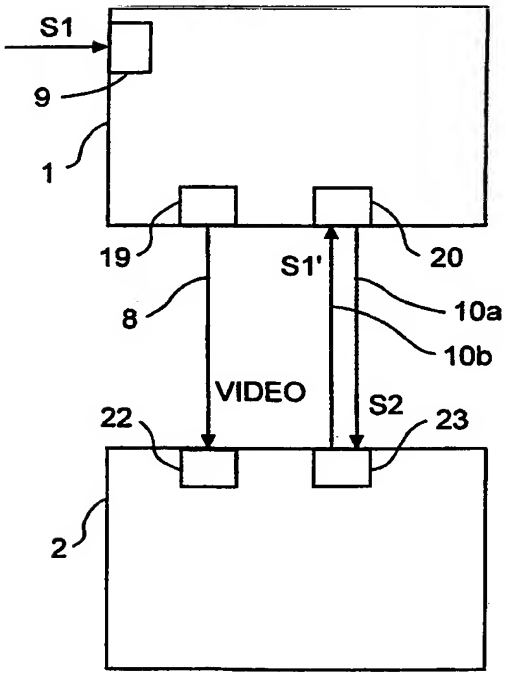

Fig. 11

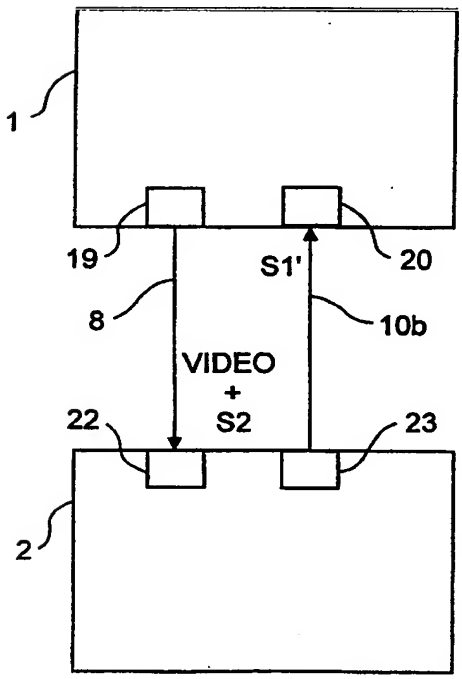

Fig. 12

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 00/00449

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: A61B 3/12, A61B 3/14
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: A61B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5668621 A (T. NANJO), 16 Sept 1997 (16.09.97), column 4, line 19 - line 67; column 6, line 18 - line 30	1-12
A	US 5125730 A (G.R. TAYLOR ET AL.), 30 June 1992 (30.06.92), column 9, line 3 - line 40, abstract	1-12
A	US 5202708 A (K. SASAKI ET AL.), 13 April 1993 (13.04.93), column 8, line 40 - line 46, abstract	1-12

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" erlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 Sept 2000	25 -09- 2000
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Nikolaj Hautaviita/AE Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

Information on patent family members

01/08/00

International application No.
PCT/FI 00/00449

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5668621 A	16/09/97	JP 8299278 A	19/11/96
US 5125730 A	30/06/92	NONE	
US 5202708 A	13/04/93	JP 2942321 B	30/08/99
		JP 4096730 A	30/03/92
US 5701904 A	30/12/97	NONE	